B.Tech. SEM -IV (Chemical) 2014 Course (CBCS) : SUMMER - 2019

SUBJECT: CHEMICAL ENGINEERING THERMODYNAMICS – II

Day: Thursday | Time: 10.00 AM TO 01.00 PM

Date: 30/05/2019 | **S-2019-2594** | Max Marks: 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labeled diagram **WHEREVER** necessary.
4) Assume suitable data, if necessary.

Q.1 a) Prove fugacity of species 'i' in an ideal gas mixture is equal to its partial pressure **(06)**

$f_i^{ig} = P_i = y_i P$

b) Write expressions for property changes of mixing **(04)**

OR

Q.1 Elaborate the following terms **(10)**

i) Ideal gas mixture
ii) Ideal solution
iii) Activity in solution
iv) Activity coefficient

Q.2 Following binary system conforms closely Raoults law: Acetonitrile (1) and nitromethane (2). Prepare T-x_1y_1 diagram for a pressure of 70kPa. Antoine coefficients for two species are: **(10)**

Component	A	B	C
Acetonitrile	14.27	2945.47	49.15
Nitromethane	14.20	2972.64	64.15

OR

Q.2 a) Derive expression for criteria of phase equilibria in a single component system **(05)**

b) Explain constant pressure equilibrium using T-xy diagram **(05)**

Q.3 Illustrate the determination of liquid phase property excess Gibbs energy from VLE data. Write the expressions for same **(10)**

OR

Q.3 a) Elaborate qualitative behavior of VLE **(04)**

b) State and enumerate **(06)**

i) Lewis Randall law
ii) Henrys law

P. T. O.

Q.4	**a)**	Derive the relationship between mole fraction of species and extent of reaction for multiphase reactions.	**(05)**
	b)	Derive an expression relating chemical reaction equilibrium constant with mole fraction of components for liquid phase reactions.	**(05)**

OR

Q.4	**a)**	Derive Van't Hoff equation which predicts effect of temperature on equilibrium constant.	**(05)**
	b)	How phase rule is applied for reacting system? Enumerate with suitable example.	**(05)**
Q.5	**a)**	Discuss the role of thermodynamics in industrial heterogeneous systems with suitable example.	**(05)**
	b)	For a solid decomposition reaction, derive an expression of pressure of decomposition.	**(05)**

OR

Q.5		Calculate the composition at equilibrium assuming ideal gas behavior for following system. Five moles of steam reacts with one mole methane according to the following reaction at 850K and 1 bar: $CH_4 + H_2O \rightarrow CO + 3H_2$ K_1=0.574 $CO + H_2O \rightarrow CO_2 + H_2$ K_2=2.21	**(10)**
Q.6	**a)**	Define solubility parameter and how is it estimated?	**(05)**
	b)	Write the expressions of activity coefficients for LLE.	**(05)**

OR

Q.6		Write notes on following: i) Selection of extractant ii) Partition coefficient iii) Constant pressure LLE in binary system.	**(10)**

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